PATENT ABSTRACTS OF JAPAN

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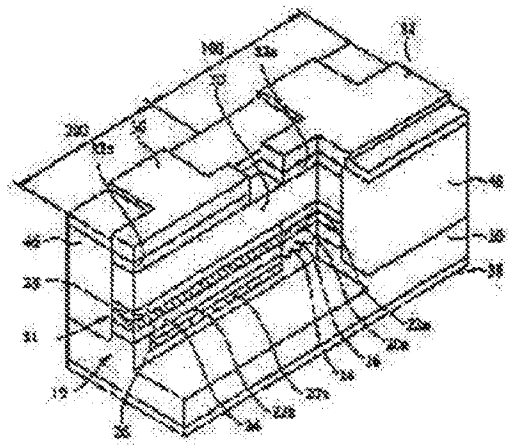
(54) INTEGRATED SEMICONDUCTOR OPTICAL ELEMENT AND ITS MANUFACTURE

(57)Abstract:
PROBLEM TO BE SOLVED: To make it possible to generate an outgoing waveguide light beam while an influence of stray light is reduced, and reduce the number of manufacturing steps.
SOLUTION: In an optical element, an oscillation region 100 and an optical modulator region 200 are formed integrally, and an active layer 20a of the oscillation region 100 and a modulation absorption layer 26 of the optical modulator region 200 are joined continuously. In addition, a stray light absorption layer 20b is formed at a position lower than that of the modulation absorption layer 26, and the stray light absorption layer 20b is extended from the joined part between the active layer 20a of the oscillation region 100 and the modulation absorption layer 26 to a position just in front of an outgoing edge face 19 of the optical modulator region 200.



CLAIMS

[Claim(s)]
[Claim 1]In an accumulated type semiconductor light corpuscle child with whom an oscillation region and an optical modulator region unite with, and an active layer of said oscillation region and a modulation absorption layer of said optical modulator region are combined continuously, An accumulated type semiconductor light corpuscle child providing a stray light absorption layer below said modulation absorption layer, and having provided this stray light absorption layer from a bond part of said active layer and said modulation absorption layer to a position in front of an emitting end surface of said optical modulator region.
[Claim 2]An accumulated type semiconductor light corpuscle child having considered material of said stray light absorption layer and said active layer, and a presentation as the same composition in the accumulated type semiconductor light corpuscle child according to claim 1.
[Claim 3]An accumulated type semiconductor light corpuscle child's manufacturing method characterized by

comprising the following.
A process of forming a selective growth mask in the surface of said 1st conductivity type substrate of said optical modulator region in manufacturing an accumulated type semiconductor light corpuscle child by whom an oscillation region and an optical modulator region unify, and an active layer of said oscillation region and a modulation absorption layer of said optical modulator region are continuously combined on the 1st conductivity type substrate.
A process of forming a diffraction grating in the surface of the 1st conductivity type substrate of said oscillation regions other than this selective growth mask.
A process of forming the 1st cladding layer on this diffraction grating.
A process of forming an etching mask of island shape in a field by the side of an emitting end surface of said optical modulator region on this 1st cladding layer and said selective growth mask, A process of removing said a part of 1st conductivity type substrate of said selective growth mask exposed in addition to this etching mask, and this selective growth mask bottom one by one, and forming a slot in said optical modulator region, A process of removing said etching mask of said oscillation region and said optical modulator region, A process of forming a stray light absorption layer simultaneously on said 1st conductivity type substrate exposed to said slot bottom of an active layer and said optical modulator region on said 1st cladding layer of said oscillation region, A process of forming the 2nd cladding layer simultaneously on this stray light absorption layer and said active layer, A process of forming the 3rd cladding layer on said 2nd cladding layer of said optical modulator region, and said 1st exposed conductivity type substrate after removing said selective growth mask which remains in said optical modulator region side, and a process of making it combining with said active layer, and forming a modulation absorption layer on this 3rd cladding layer.

[Translation done.]

DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Field of the Invention]This invention relates to an accumulated type semiconductor light corpuscle child and a manufacturing method for the same.
[0002]
[Description of the Prior Art]There is an element currently indicated by JP,6-77583,A as a conventional accumulated type semiconductor light corpuscle child (optical modulator type integration laser). This integration laser carries out unification formation of a DBR laser field and the optical modulator region, and is constituted. And the active layer for oscillating a laser beam is provided in the DBR laser field.
On the other hand, the modulation absorption layer for entering and carrying out light modulation of the laser beam is provided in the optical modulator region.
The active layer and the modulation absorption layer are combined linearly. And in this integration laser, the stray light absorption layer (synchrotron radiation absorption layer) for absorbing the stray light (synchrotron radiation) is provided in the modulation absorption layer upper part of an optical modulator region.
[0003]
[Problem(s) to be Solved by the Invention]However, when manufacturing the conventional integration laser, in order to grow up the layer of an oscillation region and an optical modulator region separately, mismatching arises in the plane of union of an active layer and a modulation absorption layer. That is, a plane of union with the active layer of a modulation absorption layer does not become linear, but serves as field (curvature faces are

called.) shape with a certain curvature which looks at a section, and produces a level difference in a plane of union. If such mismatching arises, the stray light produced by the scattered reflection of waveguide light or leakage in the bond part of an active layer and a modulation absorption layer will spread the layer of the modulation absorption layer bottom.

[0004]since [appropriate] it was alike and the conventional integration laser has provided the stray light absorption layer in the modulation absorption layer upper part, it cannot absorb the stray light which spreads the modulation absorption layer bottom. For this reason, it had become the cause of being unable to quench the stray light even if it impresses voltage to an optical modulator region, therefore degrading a quenching characteristic.

[0005]If the stray light is outputted from the emitting end surface of an optical modulator region, in order for the stray light and waveguide light to overlap and to cause interference, when combination with an optical fiber and integration laser was performed, there was a problem that coupling efficiency fell.

[0006]In the conventional integration laser, since the stray light absorption layer is formed to the emitting end surface of an optical modulator region, it will be reflected in an emitting end surface and the stray light component which is not absorbed by a stray light absorption layer will affect waveguide light.

[0007]When manufacturing the conventional integration laser, the DBR laser field and the optical modulator region are formed independently, respectively. For this reason, the routing counter increased and it had become a cause of the cost hike.

[0008]Then, an appearance of the manufacturing method of the accumulated type semiconductor device which can reduce the accumulated type semiconductor light corpuscle child who reduces the influence of the stray light and makes good waveguide light emit, and a manufacturing process was desired.

[0009]

[Means for Solving the Problem]For this reason, in an accumulated type semiconductor light corpuscle child with whom according to the accumulated type semiconductor light corpuscle child of this invention an oscillation region and an optical modulator region unite with, and an active layer of an oscillation region and a modulation absorption layer of an optical modulator region are combined continuously, A stray light absorption layer is provided below a modulation absorption layer, and this stray light absorption layer is provided from a bond part of an active layer and a modulation absorption layer to a position in front of an emitting end surface of an optical modulator region.

[0010]Thus, in this invention, since a stray light absorption layer is provided below a modulation absorption layer, the stray light spread below a modulation absorption layer produced in a bond part (butted joint part) of an active layer and a modulation absorption layer is absorbable by a stray light absorption layer.

[0011]A stray light absorption layer is provided from a bond part of an active layer and a modulation absorption layer to a position in front of an emitting end surface of an optical modulator region. That is, a stray light absorption layer is stopped in a position before an emitting end surface of an optical modulator region. For this reason, since the stray lights which remained without being absorbed by a stray light absorption layer are scattered about by a waveguide (here the 1st conductivity type substrate) in front of an emitting end surface of an optical modulator region, reflectance in an emitting end surface decreases. Therefore, the stray light is reflected in an emitting end surface, and influence which it has on waveguide light can be avoided.

[0012]It is good to have considered material of a stray light absorption layer and an active layer, and a presentation as the same composition preferably in implementation of this invention.

[0013]Since a stray light absorption layer and an active layer can be formed at 1 time of a process by having such composition, improvement in workability can be aimed at compared with the former.

[0014]According to a method of manufacturing an accumulated type semiconductor light corpuscle child of this invention, on the 1st conductivity type substrate, In manufacturing an accumulated type semiconductor light corpuscle child with whom an oscillation region and an optical modulator region unite with, and an active layer of an oscillation region and a modulation absorption layer of an optical modulator region are combined continuously, A process of forming a selective growth mask in the surface of the 1st conductivity type substrate of an optical modulator region, A process of forming a diffraction grating in the surface of the 1st conductivity type substrate of oscillation regions other than this selective growth mask, A process of forming an etching mask of island shape in a process of forming the 1st cladding layer on this diffraction grating, and a field by the side of an emitting end surface of an optical modulator region on this 1st cladding layer and a selective growth mask, A process of removing a part of 1st conductivity type substrate of a selective growth mask exposed in addition to this etching mask, and this selective growth mask bottom one by one, A process of removing an etching mask of an oscillation region and an optical modulator region, and forming a slot in an optical modulator region, A process of forming a stray light absorption layer simultaneously on the 1st conductivity type substrate exposed to the slot bottom of an active layer and an optical modulator region on the 1st cladding layer of an oscillation region,

and a process of forming the 2nd cladding layer simultaneously on this stray light absorption layer and an active layer further, After removing a selective growth mask which remains in the optical modulator region side, a process of forming the 3rd cladding layer on the 2nd cladding layer of an optical modulator region and the 1st conductivity type substrate, and a process of making it combining with an active layer and forming a modulation absorption layer on this 3rd cladding layer are included.

[0015]Since the 2nd cladding layer that forms simultaneously an active layer of an oscillation region and a stray light absorption layer of an optical change machine field, and is formed on the active layer concerned and a stray light absorption layer is formed simultaneously according to the manufacturing method of this invention, a routing counter can be reduced compared with the former. Therefore, a KOKUTO down of a part and a product in which a routing counter was reduced can be aimed at.

[0016]

[Embodiment of the Invention]Hereafter, with reference to figures, the accumulated type semiconductor light corpuscle child of this invention and especially here explain per embodiment of distributed feedback (DFB) laser with a modulator, and a manufacturing method for the same. The size, shape, and arrangement relationship of each constituent are only shown roughly, therefore this invention is not limited to the example of a graphic display at all to such an extent that drawing 1 - 5 can understand this invention.

[0017][Structure of a DFB laser with a modulator] With reference to drawing 1 and drawing 2, it explains per structure of the DFB laser with a modulator of this invention. Drawing 1 is a partial notch perspective view for explaining the main structures of a DFB laser with a modulator, and drawing 2 is a figure showing the cut end section in the position cut along with the waveguide. In drawing 1, hatching showing a section is omitted except for the part.

[0018]The oscillation region 100 and the optical modulator region 200 unify the DFB laser with a modulator of this invention, and the active layer 20a of the oscillation region 100 and the modulation absorption layer 26 of the optical modulator region 200 are combined continuously (drawing 1 and drawing 2).

[0019]. The oscillation region 100 was formed one by one on the 1st conductivity type substrate (n-InP substrate) 10, respectively. It has the diffraction grating 14, the 1st cladding layer (n-InGaAs layer) 16, the active layer 20a, the 2nd cladding layer (p-InP layer) 22a, the 5th cladding layer (p-InP layer) 30, the 1st contact layer (p-InGaAs layer) 32a, and the 1st p type electrode 34. Here, the oscillation region 100 is also called a laser region.

[0020]It gets with that well-known, and in the surface of the substrate 10, the diffraction grating 14 is formed in uneven shape so that a diffraction operation may be produced. The 1st conductivity type substrate 10 is used as n-InP substrate in this example of composition, Make the 1st cladding layer 16 into n-InGaAs layer, and the active layer 20a is used as the layer of five cycles for example, it comprises InGaAsP layers and an InGaAs layer, The 2nd cladding layer 22a is made into p-InP layer, the 5th cladding layer 30 is made into p-InP layer, the 1st contact layer 32a is made into p-InGaAs layer, and the 1st p type electrode 34 is made into Cr/Au.

[0021]In this embodiment, the optical modulator region 200, The stray light absorption layer 20b formed one by one on n-InP substrate 10, respectively, The 2nd cladding layer (p-InP layer) 22b, It is constituted by the 3rd cladding layer (n-InP layer) 24, the modulation absorption layer 26, the 4th cladding layer (p-InP layer) 28, the 5th cladding layer (p-InP layer) 30, the 2nd contact layer (p-InGaAs layer) 32b, and the 2nd p type electrode 36.

[0022]In this example of composition, the stray light absorption layer 20b is made into the active layer 20a, and the same InGaAsP/InGaAs layer, Make the 2nd cladding layer 22b into p-InP layer, and the 3rd cladding layer 24 is made into n-InP layer, For example, it comprises InGaAsP layers and InGaAsP layers in the modulation absorption layer 26, it is considered as the layer of seven cycles, the 4th cladding layer 28 is made into p-InP layer, the 2nd contact layer 32b is made into p-InGaAs layer, and the 2nd p type electrode 36 is made into Cr/Au.

[0023]The stray light absorption layer 20b and the 2nd cladding layer 22b are formed all over the slot established in the substrate 10, and the surface of the 2nd cladding layer 22b is formed as a flat face so that it may become the diffraction grating 14 with the same flat surface substantially.

[0024]The 1st cladding layer 16 and the 3rd cladding layer 24 are formed adjacently, and the surface of both the layers 16 and 24 forms one flat face substantially. The active layer 20a and the modulation absorption layer 26 are formed so that it may become the same side substantially.

[0025]The 2nd cladding layer 22a and the 4th cladding layer 28 are formed so that it may become one flat face substantially.

[0026]The stray light absorption layer 20b and the 2nd cladding layer 22b are formed from the bond part (butt joint bond part) of the active layer 20a and the modulation absorption layer 26 to the position in front of the emitting end surface 19 of the optical modulator region 200 (this side).

[0027]The active layer 20a forms the optical waveguide of the laser region 100, and the modulation absorption

layer 26 forms the optical waveguide of the optical modulator region 200. And these layers 20a and 26 are constituted in the shape of mesa 51 on the substrate 10 at least (drawing 1).
[0028]The diffraction grating 14, the 1st cladding layer 16, the active layer 20a 2nd cladding layer 22a and, and the 5th cladding layer 30 constitute the laser region 100 from this example of mesa composition. On the other hand, the optical modulator region 200 consists of the stray light absorption layer 20b, the 2nd cladding layer 22b, the 3rd cladding layer 24, the modulation absorption layer 26, the 4th cladding layer 28, and the 5th cladding layer 30. On both sides of both the optical waveguides of the structure of the mesa 51, the SI-InP embedded layer 46 is embedded, for example (drawing 1).
[0029]The 1st contact layer 32a of the laser region 100 and the 2nd contact layer 32b of the optical modulator region 200, It dissociates near the bond part of the laser region 100 and the optical modulator region 200, and the 1st p type electrode 34 and the 2nd p type electrode 36 are formed, respectively on each 1st and 2nd contact layers 32a and 32b.
[0030]On the other hand, the n type electrode 38 common to the laser region 100 and the optical modulator region 200 is formed in the rear face of the substrate 10. The antireflection film 40 is formed in the emitting end surface 19 of the optical modulator region 200.
[0031]Thus, in this embodiment, since the stray light absorption layer 20b is formed in the modulation absorption layer 26 bottom, the stray light produced in the bond part of the active layer 20a and the modulation absorption layer 26 is absorbable by the stray light absorption layer 20b of the optical modulator region 200. For this reason, the stray light emitted from the emitting end surface 19 of the optical modulator region 200 is separable from waveguide light.
[0032]In this invention, the stray light absorption layer 20b is formed just before the emitting end surface 19 of the optical modulator region 200. For this reason, since the stray light components which remained without being absorbed by the stray light absorption layer 20b are scattered about with the substrate 10 by the side of the emitting end surface 19, the stray light which is reflected in the emitting end surface 19 and returns to the laser region 100 also decreases. Therefore, the influence which it is reflected by the emitting end surface 19 and the stray light has on the waveguide light of the laser region 100 can be reduced.
[0033]Next, with reference to drawing 3, it explains per transfer model of waveguide light and the stray light. Drawing 3 is a figure for explaining signs that waveguide light and the stray light when the DFB laser with a modulator of this invention is used spread.
[0034]When forming the conventional integration laser or the DFB laser with a modulator of this invention, each class of the laser region 100 is formed first, and each class of the optical modulator region 200 is formed after that. For this reason, mismatching arises in the connecting part of the laser region 100 and the optical modulator region 200. That is, in the bond part 44 of the laser region 100 and the optical modulator region 200, the stray light absorption layer 20b, the 2nd cladding layer (p-InP layer) 22b, the 3rd cladding layer (n-InP layer) 24, and the modulation absorption layer 26 serve as the curvature faces 50 of a certain curvature which curved when seen in the section (drawing 3). For this reason, the stray light (SL) generated in the bond part 44 of the active layer 20a and the modulation absorption layer 26 is spread toward under surface than the modulation absorption layer 26 by the difference of a refractive index between the modulation absorption layer 26, the 4th cladding layer 28, and the 3rd cladding layer 24. Since the stray light absorption layer 20b is formed in the modulation absorption layer 26 bottom, the stray light (SL) spreads the 3rd clad 24 and the 2nd cladding layer 22b, reaches the stray light absorption layer 20b, and is absorbed.
[0035]As mentioned above, since the stray light components which remained without being absorbed by the stray light absorption layer 20b are scattered on n-InP substrate 10 provided in the emitting end surface side of the stray light absorption layer 20b, the reflectance in the emitting end surface 19 becomes small.
[0036][Operation of a DFB laser with a modulator] Next, with reference to drawing 2, it explains per operation of a DFB laser with a modulator.
[0037]If forward bias current is impressed to the 1st p type electrode 34 of the laser region 100, a laser beam will be oscillated by the active layer 20a. This laser beam is emitted to the modulation absorption layer 26 combined with the active layer 20a.
[0038]Next, by impressing reverse bias voltage to the 2nd p type electrode 36 of the optical modulator region 200, reverse bias voltage is impressed to the modulation absorption layer 26, and an absorption index increases. As a result, the intensity modulation of the light (waveguide light) which spreads the modulation absorption layer 26 becomes possible.
[0039]On the other hand, the stray light produced in the bond part of the active layer 20a and the modulation absorption layer 26 is spread toward the modulation absorption layer 26 bottom, and reaches the stray light absorption layer 20b. Therefore, the stray light is absorbed by the stray light absorption layer 20b.
[0040][Manufacturing method of a DFB laser with a modulator] Next, with reference to drawing 2, drawing 4, and

drawing 5, it explains per manufacturing method of a DFB laser with a modulator. (A) - (D) and (A) - (C) of drawing 4 and drawing 2 are the sectional views for explaining the manufacturing process of a DFB laser with a modulator. [of drawing 5]

[0041]According to this embodiment, n-InP substrate is used as the 1st conductivity type substrate 10. First, the laser region 100 and the optical modulator region 200 are formed on this n-InP substrate 10.

[0042]First, the selective growth mask 12 is formed in the surface of n-InP substrate 10 used as the optical modulator region 200 ((A) of drawing 4). Here, let the selective growth mask 12 be for example, a SiO_2 film. Here, although the SiO_2 film was used, a SiON film may be used instead of a SiO_2 film.

[0043]Next, the surface of n-InP substrate 10 used as the laser region 100 is etched, and the diffraction grating 14 is formed ((B) of drawing 4). Here, the diffraction grating 14 is formed in predetermined even pitch.

[0044]Next, the 1st cladding layer (n-InGsAs layer) 16 is formed on the diffraction grating 14 using metal-organic chemical vapor deposition (MOVPE method) ((C) of drawing 4). According to this embodiment, the 1st cladding layer 16 is also called a grating embedded layer.

[0045]Next, the etching mask 18 of island shape is formed in the field 12a by the side of the emitting end surface 19 of the optical modulator region 200 on the 1st cladding layer 16 and the selective growth mask 12 using photolithography technique ((D) of drawing 4). Here, let the etching mask 18 be for example, a SiO_2 film.

[0046]Next, a part of n-InP substrate 10 of the selective growth mask [which has been exposed in addition to etching mask 18] 12 and selective growth mask 12 bottom concerned is removed one by one using the dry etching method ((A) of drawing 5). As etching gas for the dry etching at this time, CF_4 gas is used, for example. The concave slot 21 is formed in the optical modulator region 200 by performing such dry etching. Here, the depth of the concave slot 21 is made deeper than the position of the diffraction grating 14, i.e., the depth of unevenness of the diffraction grating 14.

[0047]Next, the etching mask 18 currently formed in the laser region 100 and the optical modulator region 200 is removed. The stray light absorption layer 20b is simultaneously formed on n-InP substrate 10 which the active layer 20a and the optical modulator region 200 exposed on the 1st cladding layer 16 of the laser region 100 ((B) of drawing 5). Therefore, in this embodiment, the active layer 20a and the stray light absorption layer 20b are formed by the identical material and the same presentation, and the active layer 20a and the stray light absorption layer 20b are discontinuously formed with a level difference, respectively. The active layer 20a and the stray light absorption layer 20b are constituted by the suitable cycle, for example, the layer of five cycles, which comprises a barrier (InGaAsP) layer and a well layer (InGaAs) (not shown).

[0048]The 2nd cladding layer 22a and 22b is simultaneously formed, respectively on the active layer 20a and the stray light absorption layer 20b ((B) of drawing 5). At this time, the 1st cladding layer 22a on the active layer 20a and the 2nd cladding layer 22b on the stray light absorption layer 20b are discontinuously formed with a level difference, respectively. Thickness of the stray light absorption layer 20b of the optical modulator region 200 and the 2nd cladding layer 22b is taken as the thickness to a position lower than the position of the active layer 20a. Here, let the 2nd cladding layer 22a and 22b be p-InP layer.

[0049]Next, after removing the selective growth mask 12 which remains in the optical modulator region 200 side, the 2nd selective growth mask 29 is newly formed on the 2nd cladding layer 22a.

[0050]Next, the 3rd cladding layer 24 is formed in the field of the 2nd cladding layer 22b top of the optical modulator region 200, and the surface of the exposed substrate 10 using MOVPE method. Here, let the 3rd cladding layer 24 be n-InP layer.

[0051]Then, using MOVPE method, on the 3rd cladding layer 24 of the optical modulator region 200, it is made to combine with the active layer 20a, and the modulation absorption layer 26 is formed ((C) of drawing 5). According to this embodiment, the modulation absorption layer 26 is made into the suitable cycle, for example, the layer of seven cycles, which comprises a barrier layer (InGaAs layer) and a well layer (InGaAs layer). At this time, the modulation absorption layer 26 and the active layer 20a will be combined continuously. Here, thickness of the modulation absorption layer 26 is made into the thickness to the almost same field as the upper surface of the active layer 20a.

[0052]The manufacturing process of the DFB laser with a modulator after mentioning above is performed by that well-known and the process in which it deals.

[0053]That is, the 4th cladding layer 28 is selectively formed on the modulation absorption layer 26 using MOVPE method. Here, the 4th cladding layer 28 is made into p-InP layer, and the thickness is grown up until it becomes the almost same height as the 2nd cladding layer 22a of the laser region 100 (drawing 5 ((C)).).

[0054]Next, after removing the 2nd selective growth mask 29, the 5th cladding layer (p-InP layer) 30 is formed on the 2nd cladding layer 22a and the 4th cladding layer 28 (drawing 2).

[0055]Next, from the 5th cladding layer 30 of the laser region 100 to some substrates 10 of the diffraction

grating 14 bottom and from the 5th cladding layer 30 of the optical modulator region 200 to the part of the substrate 10 of the stray light absorption layer 20a bottom are etched simultaneously, and a mesa-like optical waveguide is formed (not shown). Then, the embedded layer (SI-InP layer) 46 (refer to drawing 1) is embedded on both sides of a mesa-like optical waveguide. It is good to make mostly thickness of the embedded layer 46 at this time into the thickness about the same with the upper surface of the 5th cladding layer 30.

[0056]Next, a contact layer (not shown) is formed on the embedded layer 46 concerned and the 5th cladding layer 30, for example using vacuum deposition. Here, let a contact layer be p-InGaAs layer.

[0057]Next, photolithographic technique separates a contact layer in the field near the laser region 100 and the optical modulator region 200. According to this embodiment, the contact layer of the separated laser region 100 is called the 1st contact layer 32a, and the contact layer of the optical modulator region 200 is called the 2nd contact layer 32b.

[0058]Next, on the 1st contact layer 32a, the 1st p type electrode 34 is formed, for example using vacuum deposition, and the 2nd p type electrode 36 is formed on the 2nd contact layer 32b.

[0059]Next, the n type electrode 38 is formed also in the rear face of the substrate 10 using vacuum deposition. Then, the antireflection film (AR coating film) 40 is formed in the emitting end surface 19 of the optical modulator region 200 using arbitrary suitable methods (drawing 2). The DFB laser with a modulator is completed through the process mentioned above.

[0060]According to the embodiment of the manufacturing method of this invention, the active layer 20a of the laser region 100 and the stray light absorption layer 20b of the optical modulator region 200 are formed simultaneously, And since the 2nd cladding layer 22a and 22b of both the fields 100 and 200 is formed simultaneously, a routing counter can be reduced compared with the former.

[0061]According to the embodiment mentioned above, although explained per example of a DFB laser with a modulator, it is not limited to this DFB laser with a modulator at all, and can apply also to the accumulated type semiconductor light corpuscle child by whom a semiconductor laser, optical amplifier, etc. were integrated, for example.

[0062]Although explained per [having used / n-InP substrate / as a substrate] example, a GaAs substrate etc. may be used, for example.

[0063]

[Effect of the Invention]According to the accumulated type semiconductor light corpuscle child of this invention, a stray light absorption layer is provided below a modulation absorption layer, and the stray light absorption layer is provided from the bond part of an active layer and a modulation absorption layer to the position in front of the emitting end surface of an optical modulator region so that clearly also from the explanation mentioned above. For this reason, the stray light produced in the bond part of the active layer and the modulation absorption layer spreads fields (field below a modulation absorption layer) other than a modulation absorption layer, and reaches the stray light absorption layer 20b. Since it will be absorbed by this layer if the stray light enters into a stray light absorption layer, the stray light and waveguide light are separable. Therefore, when performing combination with an optical fiber and a light corpuscle child, the part and coupling light efficiency which it is not influenced by the stray light improve.

[0064]Since the stray light absorption layer is provided to the position in front of the emitting end surface of an optical modulator region, the stray light components which were not absorbed by a stray light absorption layer are scattered about with a substrate, and the reflectance in an emitting end surface becomes small. For this reason, the returned light of the stray light in an emitting end surface can decrease, and the influence on an oscillation region can be avoided. Therefore, a light corpuscle child's quenching characteristic is improved.

[0065]Since the active layer, the stray light absorption layer, or the 2nd cladding layer formed in an oscillation region and an optical modulator region is simultaneously formed at 1 time of a process according to the manufacturing method of the accumulated type semiconductor light corpuscle child of this invention, a routing counter can be reduced compared with the former. For this reason, working efficiency improves remarkably.

[Translation done.]

2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

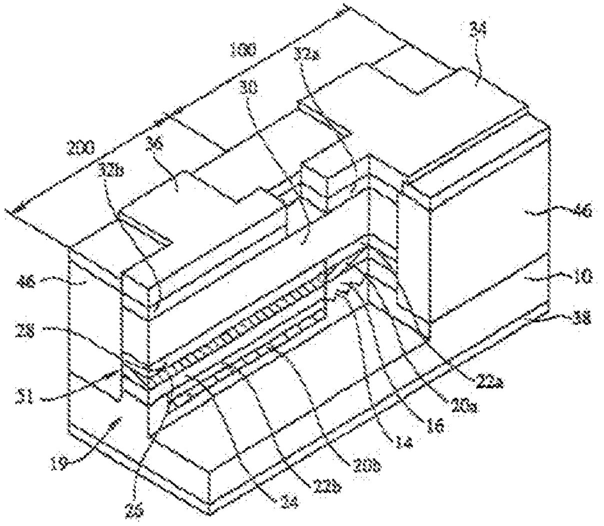
DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]
[Drawing 1]It offers in order to explain the main structures of the accumulated type semiconductor light corpuscle child of this invention — it is a notch perspective view in part.
[Drawing 2]It is a sectional view for explaining the main structures of the accumulated type semiconductor light corpuscle child of this invention.
[Drawing 3]It is a figure for explaining the transfer model of waveguide light and the stray light.
[Drawing 4](A) - (D) is process drawing for explaining the manufacturing method of the accumulated type semiconductor light corpuscle child of this invention.
[Drawing 5](A) - (C) is process drawing for explaining a manufacturing method following drawing 4.
[Description of Notations]
10: n-InP substrate
12: Selective growth mask
14: Diffraction grating
16: The 1st cladding layer (n-InGaAs layer)
18: Etching mask
19: Emitting end surface
20a: Active layer
20b: Stray light absorption layer
22a, 22b: The 2nd cladding layer (p-InP layer)
24: The 3rd cladding layer (n-InP layer)
26: Modulation absorption layer
28: The 4th cladding layer (p-InP layer)
30: The 5th cladding layer (p-InP layer)
32a: The 1st contact layer (p-InGaAs layer)
32b: The 2nd contact layer (p-InGaAs layer)
34: The 1st p type electrode
36: The 2nd p type electrode
38: N type electrode
40: Antireflection film
46: Embedded layer
100: Laser region (oscillation region)
200: Optical modulator region

[Translation done.]

DRAWINGS

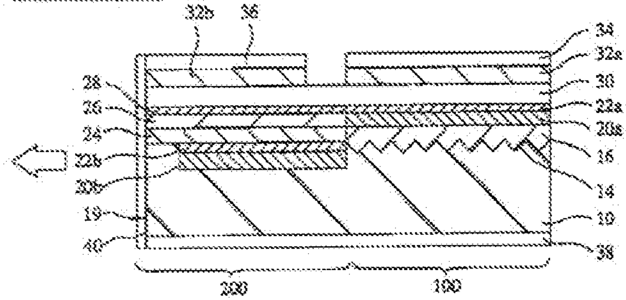
[Drawing 1]



10：n－InP基板	16：第1クラッド層
20a：活性層	22a,22b：第2クラッド層
20b：迷光吸収層	24：第3クラッド層
26：変調吸収層	28：第4クラッド層
30：第5クラッド層	32a：第1コンタクト層
32b：第2コンタクト層	34：第1p型電極
36：第2p型電極	38：n型電極
46：埋め込み層（SI－InP）	51：メサ
100：レーザ領域	200：光変調器領域

この発明のDFBレーザの一部切欠き斜視図

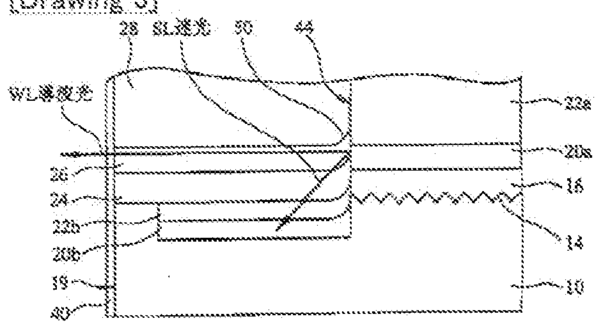
[Drawing 2]



40：反射防止膜

DFBレーザの構造

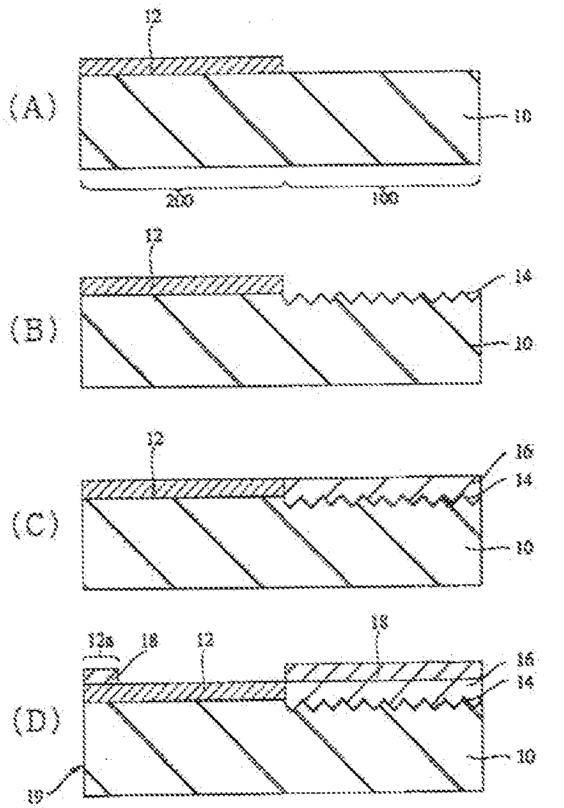
[Drawing 3]



44：結合部　50：境界面

導波光および迷光の伝播モデル

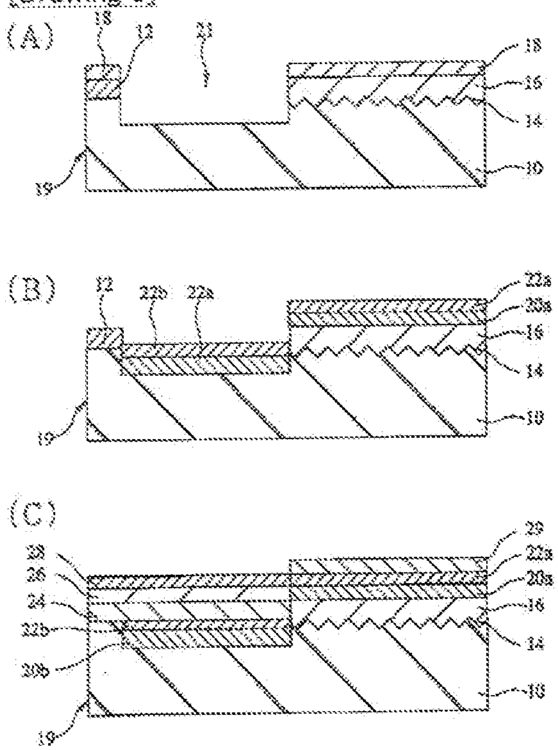
[Drawing 4]



12：選択成長マスク　14：回折格子
18：エッチングマスク　19：出射端面

工程図（その1）

[Drawing 5]



21：溝　29：選択成長マスク

工程図（その2）

[Translation done.]